

Supplementary information

**Simultaneous rupture on conjugate faults
during the 2018 Anchorage, Alaska, intraslab earthquake (M_w 7.1)
inverted from strong-motion waveforms**

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This supplementary information consists of Tables S1–S2 and Figures S1–S6.

Table S1

Focal Mechanisms of Two Moderate-Sized Aftershocks.

	Aftershock 1	Aftershock 2
Longitude [*]	150.0404° W	149.9371° W
Latitude [*]	61.3700° N	61.4826° N
Focal depth [*]	53.2 km	50.5 km
Strike [*]	N 346° E	N 186° E
Dip [*]	39°	58°
Rake [*]	250°	271°
Seismic moment [*]	3.98×10^{16} Nm (M_w 5.0)	7.08×10^{15} Nm (M_w 4.5)
Rise time [†]	1.6 s	0.8 s

^{*}Ruppert et al. (2020)

[†]Ekström et al. (2012)

Table S2

Physical Parameters in the 1D Velocity Structure Models used for the Waveform Inversions.

AHOU						
Top depth (m)	V_P (m/s) ^{**†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	1640	400	1721	44	22	4.10
150	2330	850	2037	118	59	2.74
200	2580	1050	2117	150	75	2.46
300	3040	1450	2232	214	107	2.10
950	4340	2497	2440	430	215	1.74
4084	5680	3293	2652	694	347	1.72
10584	6780	3906	2906	992	496	1.74
19584	6810	3837	2915	952	476	1.77
28584	6910	3933	2942	1006	503	1.76
40584	7380	4037	3083	1068	534	1.83
56584	7910	4414	3259	1318	659	1.79
75084	8540	4828	3491	1648	824	1.77

*Based on Dutta et al. (2007) and Eberhart-Phillips et al. (2006, 2019)

†Based on Brocher (2008)

The bold text shows the high V_P/V_S estimated by Eberhart-Phillips et al. (2006, 2019).

AWCH						
Top depth (m)	V_P (m/s) ^{**†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	1640	400	1721	44	22	4.10
50	2330	850	2037	118	59	2.74
350	2580	1050	2117	150	75	2.46
450	3040	1450	2232	214	107	2.10
500	3700	2133	2350	342	171	1.73
4103	5050	2901	2543	548	274	1.74
10603	7230	4089	3036	1100	550	1.77
19603	7400	4125	3089	1122	561	1.79
28603	7200	4147	3027	1136	568	1.74
40603	7550	4176	3137	1154	577	1.81
56603	8660	4843	3538	1660	830	1.79
75103	8650	4870	3534	1684	842	1.78

K217						
Top depth (m)	V_P (m/s) ^{**†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	3040	1450	2232	214	107	2.10
50	3700	2133	2350	342	171	1.73
4072	5050	2901	2543	548	274	1.74
10572	7230	4089	3036	1100	550	1.77
19572	7400	4125	3089	1122	561	1.79
28572	7200	4147	3027	1136	568	1.74
40572	7550	4176	3137	1154	577	1.81
56572	8660	4843	3538	1660	830	1.79
75072	8650	4870	3534	1684	842	1.78

Table S2 (continued)

K209						
Top depth (m)	V_P (m/s) ^{**†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	1830	500	1824	62	31	3.66
150	3670	2000	2345	314	157	1.84
200	3960	2250	2388	368	184	1.76
250	5000	2882	2535	542	171	1.73
4096	5680	3287	2652	692	346	1.73
10596	6830	3985	2920	1036	518	1.71
19596	6720	3869	2890	970	485	1.74
28596	7160	4117	3015	1118	559	1.74
40596	7610	4207	3157	1176	588	1.81
56596	8580	4845	3507	1662	831	1.77
75096	8460	4742	3460	1574	787	1.78

K215						
Top depth (m)	V_P (m/s) ^{**†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	3960	2250	2388	368	184	1.76
50	5000	2882	2535	542	171	1.73
4284	5680	3287	2652	692	346	1.73
10784	6830	3985	2920	1036	518	1.71
19784	6720	3869	2890	970	485	1.74
28784	7160	4117	3015	1118	559	1.74
40784	7610	4207	3157	1176	588	1.81
56784	8580	4845	3507	1662	831	1.77
75284	8460	4742	3460	1574	787	1.78

SSN						
Top depth (m)	V_P (m/s) ^{**†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	1830	500	1824	62	31	3.66
250	3670	2000	2345	314	157	1.84
350	3960	2250	2388	368	184	1.76
900	5360	2968	2593	572	286	1.81
5306	6400	3530	2808	798	399	1.81
11806	6450	3626	2821	844	422	1.78
20806	6950	4006	2954	1020	525	1.73
29806	7230	4060	3036	1082	541	1.78
41806	6990	3868	2965	970	485	1.81
57806	7880	4444	3249	1336	668	1.77
76306	8230	4681	3374	1524	762	1.76

Table S2 (continued)

SAW						
Top depth (m)	V_P (m/s) ^{*†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	2520	1000	2099	142	71	2.52
150	3670	2000	2345	314	157	1.84
500	3960	2250	2388	368	184	1.76
1800	5660	3227	2648	668	334	1.75
4781	6470	3596	2826	828	414	1.80
11281	6850	4068	2926	1086	543	1.68
20281	7090	4001	2994	1046	523	1.77
29281	6930	3915	2948	996	498	1.77
41281	7600	4167	3154	1150	575	1.82
57281	7900	4473	3256	1362	681	1.77
75781	8490	4827	3472	1646	823	1.76

SKN						
Top depth (m)	V_P (m/s) ^{*†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	1830	500	1824	62	31	3.66
350	2520	1000	2099	142	71	2.52
850	3670	2000	2345	314	157	1.84
1150	3960	2250	2388	368	184	1.76
1300	5130	2967	2555	572	286	1.73
4581	6960	3973	2957	1030	515	1.75
11081	6830	3930	2920	1004	502	1.74
20081	6670	3811	2877	938	469	1.75
29081	6980	3961	2962	1022	511	1.76
41081	7780	4487	3214	1372	686	1.73
57081	7850	4413	3238	1318	659	1.78
75581	7970	4559	3280	1426	713	1.75

PWL						
Top depth (m)	V_P (m/s) ^{*†}	V_S (m/s) [*]	ρ (kg/m ³) [†]	Q_P [†]	Q_S [†]	V_P/V_S
0	1830	500	1824	62	31	3.66
150	2520	1000	2099	142	71	2.52
500	3670	2000	2345	314	157	1.84
600	3960	2250	2388	368	184	1.76
700	5660	3247	2648	676	338	1.74
4550	5930	3446	2702	760	380	1.72
11050	6650	3815	2872	940	470	1.74
20050	7050	3930	2983	1004	502	1.79
29050	7130	3992	3006	1042	521	1.79
41050	7860	4321	3242	1252	626	1.82
57050	8140	4628	3341	1480	740	1.76
75550	8450	4820	3457	1640	820	1.75

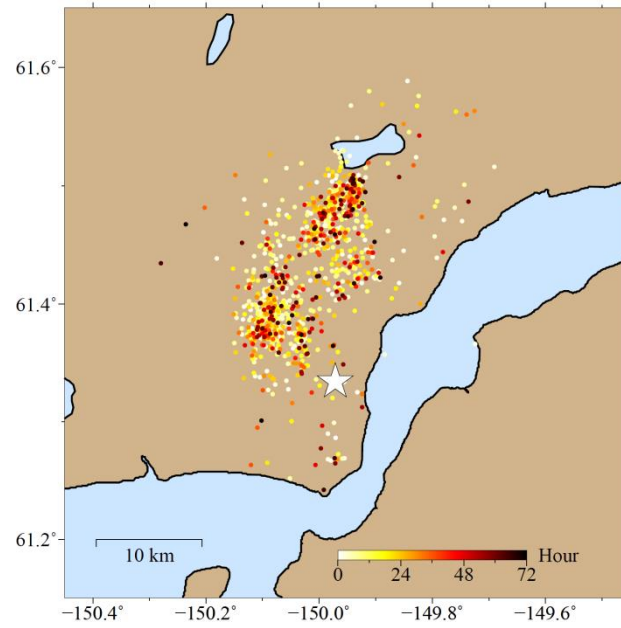


Figure S1 Spatiotemporal distribution of the relocated aftershocks within the three days following the Anchorage mainshock (plotted points).
The large star marks the epicenter of the mainshock.

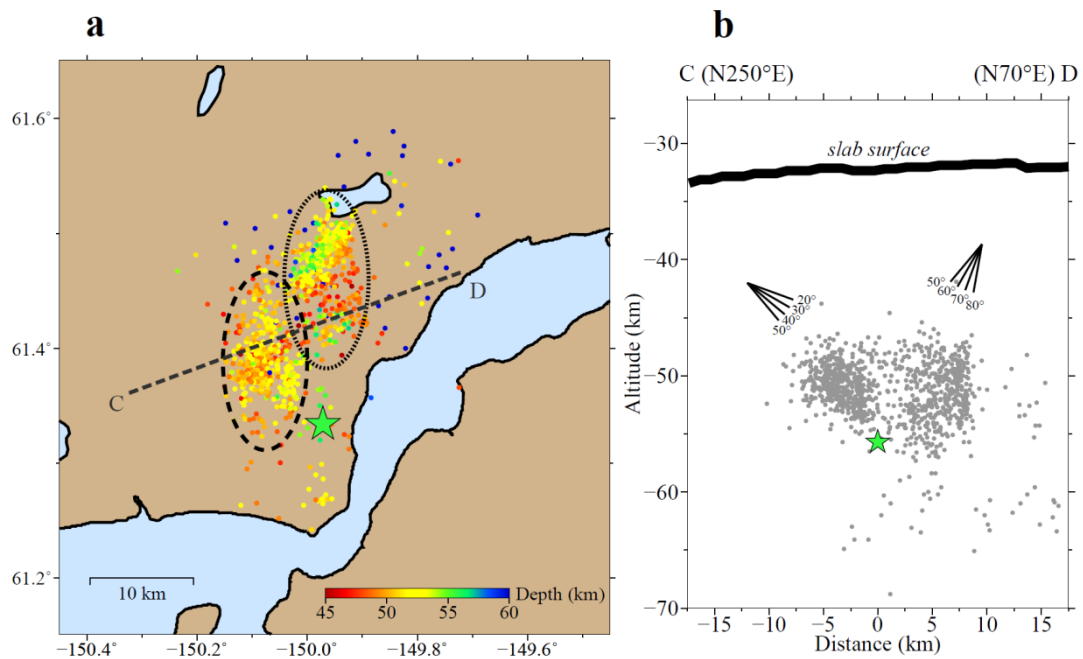


Figure S2 Relocated aftershocks within the three days following the Anchorage mainshock (plotted points).
a Map view. The large star marks the epicenter of the mainshock. The dashed and dotted ellipses denote the southern and northern aftershock clusters, respectively. **b** Cross-sectional view of the aftershocks along the linear profile C–D. The bold line indicates the slab surface.

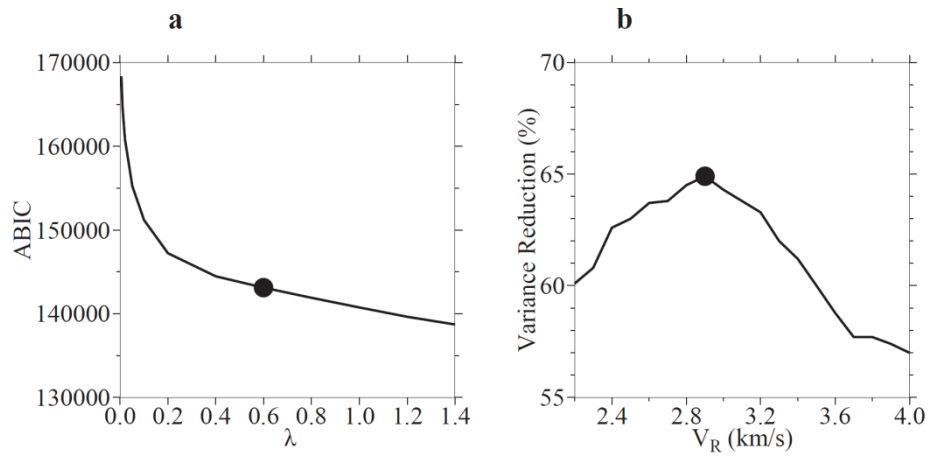


Figure S3 Weight of the smoothing constraint and rupture velocity selected by the inversion (case B).

a ABIC versus the weight of the smoothing constraint. **b** Variance reduction versus the rupture velocity. The circles denote the values selected by the inversion.

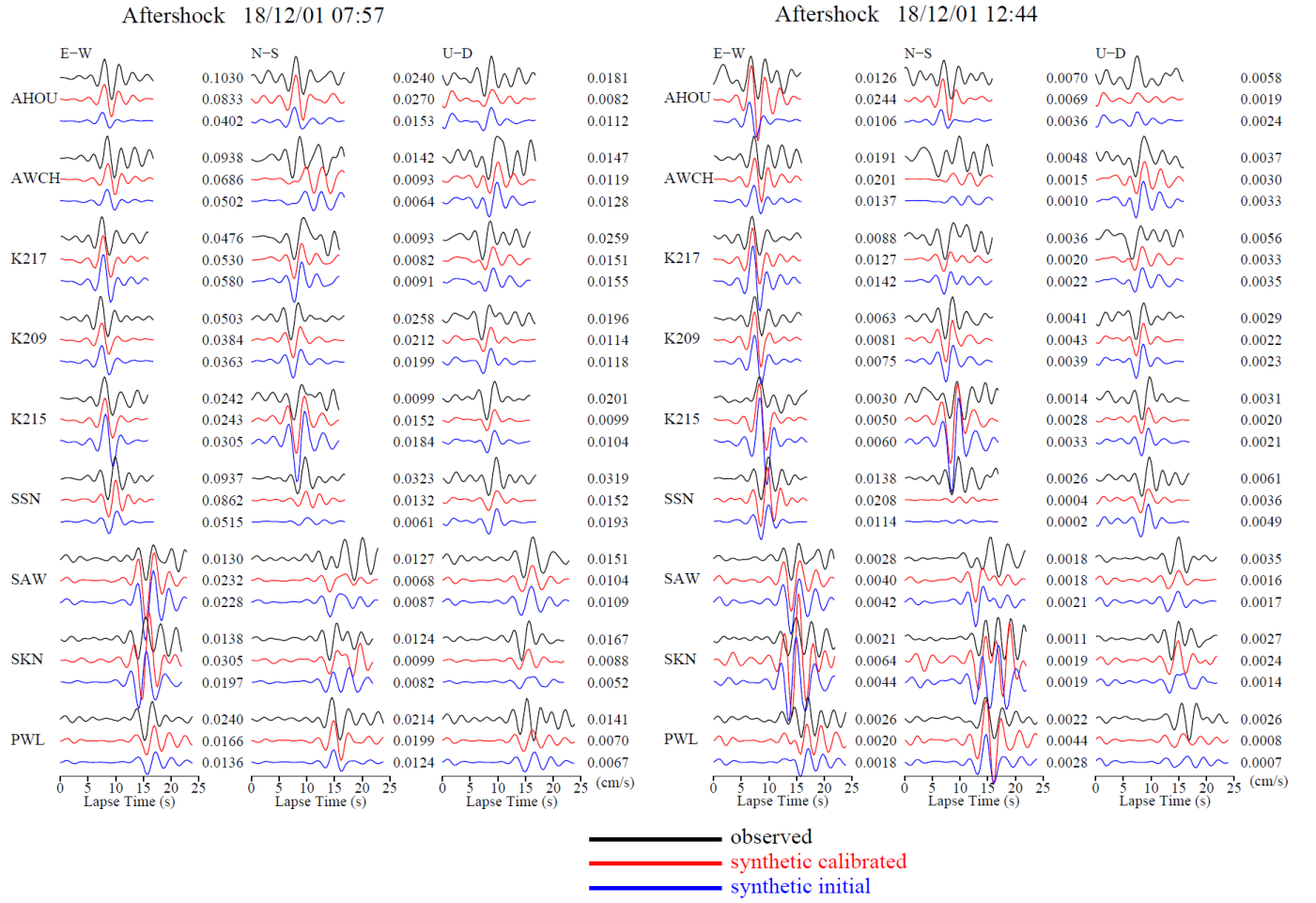


Figure S4 Velocity waveforms (0.1–0.4 Hz) during two moderate-sized aftershocks. The number to the right of each waveform denotes the peak amplitude in cm/s.

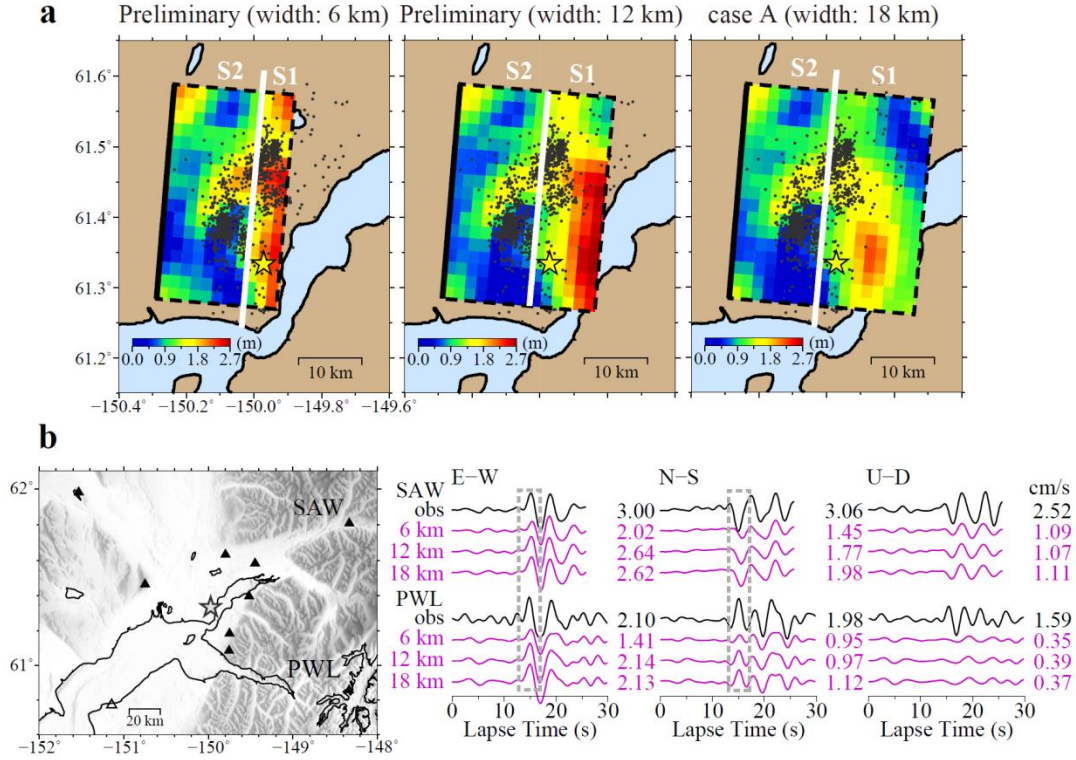


Figure S5 Preliminary inversion trials for different fault widths of segment S1.

a Map views of the final slips. The large yellow star denotes the epicenter. **b** Comparison between the observed and synthetic velocity waveforms (0.05–0.4 Hz). The number to the right of each waveform denotes the peak amplitude in cm/s. The map view shows the epicenter (star) and stations (triangles). The gray dashed lines show the waveform differences.

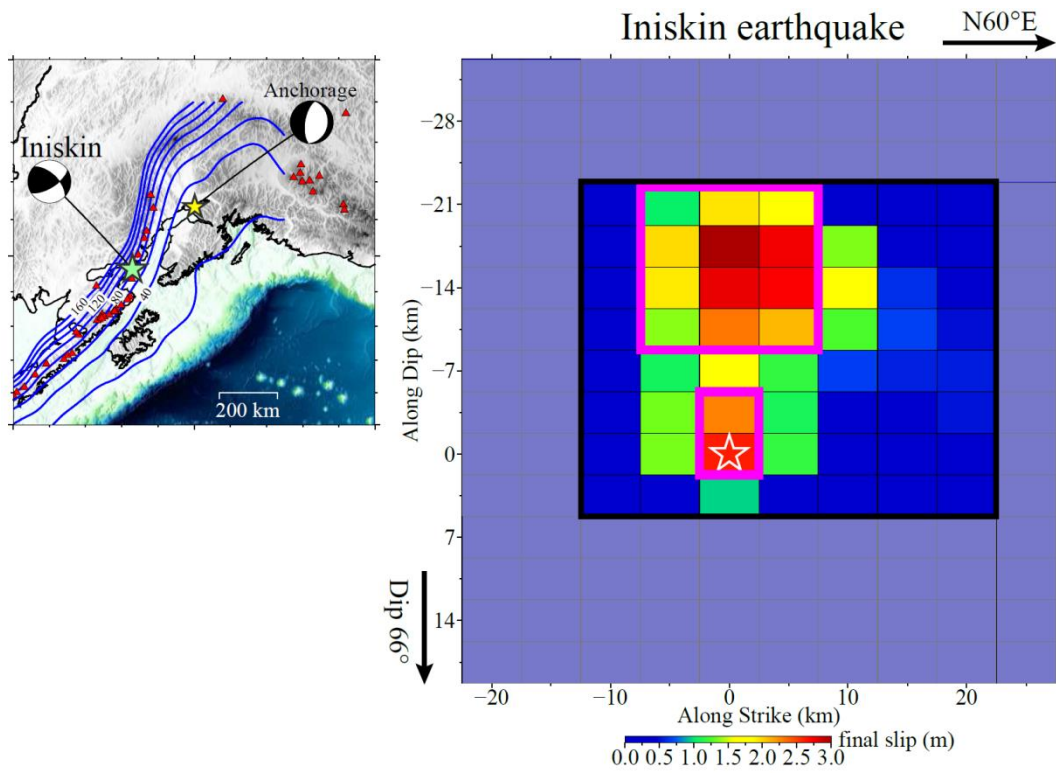


Figure S6 Slip model of the Iniskin earthquake (USGS 2018).

The star denotes the rupture initiation point. The inside of the black rectangle denotes the rupture area. The two purple rectangles indicate the large slip areas. The rupture area and the large slip areas were determined using the criteria of Somerville et al. (1999).